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(54) [Title] FOREIGN AGENT DEVICE FOR SUPPORTING MOBILE IP SERVICES IN ASYNCHRONOUS MOBILE COMMUNICATION SYSTEM AND MOBILE IP SERVICE METHOD UTILIZING THE DEVICE

(57) Abstract

1. Technical field of the invention described in the claim scope

The present invention relates to a foreign agent device for supporting mobile IP services in an asynchronous mobile communication system, a mobile IP service method utilizing said device, and a recording medium that can be read by a computer in which programs for realizing said method are recorded.

2. Technical problems to be solved by the invention

The purpose of the present invention is to provide a foreign agent device, which supports mobile IP services in an asynchronous mobile communication system that supports mobile IP services for an asynchronous mobile communication network and can support currently presented various new standards, a mobile IP service method utilizing said device, and a recording medium that can be read by a computer in which programs for realizing said methods are recorded.

3. Essence of the solution method of the invention

The present invention is characterized in that in a foreign agent device that is used in an asynchronous mobile communication system, it includes a mobile IP service registration means that controls an internal means of said foreign agent device and processes signals for a mobile IP (Internal Protocol); a network matching means that is connected to said mobile IP service registration means and matched with the asynchronous mobile communication network; an authentication protocol processing means that carries out transmission and reception through an authentication protocol with an authentication/accounting server of a mobile IP network by said foreign agent device; an authentication means that is connected with said mobile IP service registration means and said authentication protocol processing means and implements an authentication function at a foreign agent unit by the control of said mobile IP service registration means; an accounting processing means that is connected with said mobile IP service registration means and said authentication protocol processing means, collects accounting

information on packets passing through said foreign agent by the control of said mobile IP service registration means, and transmits the collected accounting information; and a packet routing and tunneling control means that designates a routing table for a mobile node by said mobile IP service registration means and implements a setup/cancellation function of a tunnel.

4. Important usage of the invention
The present invention is utilized in mobile communication services, etc.

Representative figure:

Figure 2

Keywords:

Asynchronous mobile communication, mobile IP service, foreign agent, GPRS, and GGSN

Specification

Brief description of the figures

Figure 1 is a constitutional diagram showing an application example of an asynchronous IMT-2000 system to which the present invention is applied.

Figure 2 is a constitutional diagram showing a foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

Figure 3 is a structural diagram showing an application example of signal protocol stacks that are used in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

Figure 4 is a structural diagram showing an application example of traffic stacks that are used in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

Figures 5a and 5b are flow charts showing the operations of an application example for mobile IP services in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

* Explanation of numerals of the main parts of the figures

201 GGSN matching part
202 Authentication part
203 Accounting processing part
204 DIAMETER protocol processing part
205 Packet routing and tunneling control part
206 Mobile IP service registration part

Detailed explanation of the invention

Purpose of the invention

Technical field of the invention and prior art of the field

The present invention pertains to a foreign agent device for supporting mobile IP services in an asynchronous mobile communication system, a mobile IP service method utilizing the device, and a recording medium that can be read by a computer in which programs for realizing the aforementioned method are recorded.

In existing foreign agents, access networks are regarded as wire/wireless LAN or synchronous IMT-2000. The foreign agents for providing mobile IP services in a wire/wireless LAN can carry out their roles in a pattern in which a mobile IP protocol is extended to an existing router-related protocol by using an access protocol in the second layer. In addition, in the synchronous IMT-2000, the foreign agents and the synchronous IMT-2000 can be connected by using an interface used for providing existing radio data services or a protocol of a PPP layer.

However, foreign agents that can support mobile IP services for a GPRS network as an asynchronous mobile communication system, which is standardized in the European region, are not yet presented.

In addition, many new standards are being presented, compared with the current standardized mobile IP protocols; however foreign agents that can support these new standards cannot yet be presented.

Technical problems to be solved by the invention

The present invention is proposed to solve the aforementioned conventional problems, and its purpose is to provide a foreign agent device, which supports mobile IP services in an asynchronous mobile communication system that supports mobile IP services for an asynchronous mobile communication network and can support currently presented various new standards, a mobile IP service method utilizing said device, and a recording medium that can be read by a computer in which programs for realizing said method are recorded.

Constitution and operation of the invention

In order to achieve the aforementioned purpose, the present invention is characterized in that in a foreign agent device that is used in an asynchronous mobile communication system, it includes a mobile IP service registration means that controls an internal means of the aforementioned foreign agent device and processes signals for a mobile IP (Internal Protocol); a network matching means that is connected to the aforementioned mobile IP service registration means and matched with the asynchronous mobile communication network; an authentication

protocol processing means that carries out transmission and reception through an authentication protocol with an authentication/accounting server of a mobile IP network by the aforementioned foreign agent device; an authentication means that is connected with the aforementioned mobile IP service registration means and the aforementioned authentication protocol processing means and implements an authentication function at a foreign agent unit by the control of the aforementioned mobile IP service registration means; an accounting processing means that is connected with the aforementioned mobile IP service registration means and the aforementioned authentication protocol processing means, collects accounting information on packets passing through the aforementioned foreign agent by the control of the aforementioned mobile IP service registration means, and transmits the collected accounting information; and a packet routing and tunneling control means that designates a routing table for a mobile node by the aforementioned mobile IP service registration means and implements a setup/cancellation function of a tunnel.

On the other hand, the present invention is characterized in that in a mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication system, it includes a first step for making a mobile IP service registration of a mobile node in a home agent by a mobile IP service start request signal of the mobile node received from an asynchronous mobile communication network through a network matching part by the aforementioned foreign agent; a second step for transmitting a signal through the net matching part to inform the mobile node of a mobile IP registration failure through the asynchronous mobile communication network, if the mobile IP service registration at the aforementioned first step fails; and a third step for accessing the aforementioned mobile node to the other party node through a routing and tunneling registration, if the mobile IP service registration at the aforementioned first step is successful.

On the other hand, the present invention provides a foreign agent device, which is used in an asynchronous mobile communication system having a processor, with a recording medium that can be read by a computer in which programs for realizing a first function of registering a mobile IP service mobile node for a home agent by a mobile IP service start request signal of the mobile node received from an asynchronous mobile communication network through a network matching part by the aforementioned foreign agent; a second function of transmitting a signal through the network matching part to inform the mobile node of a mobile IP registration failure through the asynchronous mobile communication network; and a third function of accessing the aforementioned mobile node to the other party node through a routing and tunneling registration, if the mobile IP service registration of the aforementioned first function is successfully recorded.

The aforementioned purpose, characteristics, and advantages will be further clarified through the following detailed explanation related to the attached figures. Next, a preferred

application example of the present invention will be explained in detail with reference to the attached figures.

Next, in the present invention, as an example of an asynchronous mobile communication network, a GPRS (General Packet Radio Service) network will be explained.

Figure 1 is a constitutional diagram showing an application example of an asynchronous IMT-2000 system to which the present invention is applied.

As shown in Figure 1, the asynchronous IMT-2000 system, to which the present invention is applied, includes a GPRS network (12) that is connected with a mobile node (11) and supports radio communications, a mobile IP network (13) for providing a mobile IP to the GPRS network (12), a public Internet (14) for providing data services, and a public telephone network (15) for telephone services of a circuit system.

First, the GPRS network (12) includes a GGSN (Gateway GPRS Support Node) (123) that matches the public Internet (14) or an Internet service provider and carries out functions as a gateway of the GPRS network (12), such as connection with a foreign agent (131) of the mobile IP network (13) to support mobile IP services, an SGSN (Serving GPRS Support Node) (122) that carries out functions of the terminal of a GTP (GPRS Tunneling Protocol) as a tunneling protocol of the GGSN (123) and the GPRS network (12) and provides packet services to all users in a service area, and a radio data network controller (Radio Network Controller: RNC) (121) for supporting telephone services of a circuit system and packet data services.

In addition, the mobile IP network (13) includes a home agent (HA) (133) that exists in a home network of the mobile node (11), delivers a mobile node reception datagram, and stores the position information of the mobile node, a foreign agent (FA) (131) that exists in the mobile node of the mobile node (11) and designates a re-route of a datagram sent from the home agent (133) for the mobile node (11), and an authentication/accounting server (AAA: Authentication, Authorization and Accounting Server) (132) for authenticating the mobile node (11).

In the entire operation, the GPRS network (12) is a network that is accessed by the mobile node (MN) (11), and the mobile node (11) accesses the radio data network controller (Radio, Network Controller: RNC) (121) by radio.

At that time, the radio data network controller (121) can support telephone services of a circuit system and packet data services, is connected with the SGSN (122) to support the packet data services, and is connected with an MSC/VLR (Mobile Switching Service Center/Visitor Location Register) (101).

Moreover, the SGSN (122) provides a session management and mobility management function for subscribers to support the packet data services of the GPRS network subscribers and matches the MSC/VLR (101) and an HLR/AC (Home Location Registration/Authorization

Center) (102) to detect information regarding the subscribers. The MSC/VLR (101) is also connected with the public telephone network (15) for the telephone services of the circuit system.

Furthermore, the GGSN (104) carries out a gateway function of the GPRS network as an asynchronous mobile communication network, matches the public Internet (14) or Internet service provider, and connects with the foreign agent (131) of the mobile IP network (13) to support the mobile IP services.

The mobile IP network (13) includes the foreign agent (131), authentication/accounting server (132), and home agent (133) and is especially connected with the GPRS network (12) by the foreign agent (131). All the nodes (131, 132, 133) of the mobile IP network (13) can transmit a control packet and traffic to the public Internet (14).

In the asynchronous IMT-2000 system to which the present invention is applied, other GPRS network subscribers joined in the mobile IP network (13) have access to the GPRS network (12) to receive the packet data services. In other words, after a mobile IP setup procedure and registration procedure, the subscribers joined in the mobile IP services through the GPRS network (12) can communicate with the other party nodes, even through other GPRS networks.

Figure 2 is a constitutional diagram showing the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

As shown in Figure 2, the foreign agent (131) for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention is provided with a GGSN matching part (201) for matching the GGSN (123) of the GPRS network, an authentication part (202) for implementing an authentication function at a foreign agent unit, an accounting processing part (203) that collects accounting information on packets passing through the foreign agent (131) and transmits the collected accounting information, a DIAMETER protocol processing part (204) for transmission and reception by a DIAMETER protocol, a packet routing and tunneling control part (205) that designates a routing table for a mobile node and implements a tunnel setup/cancellation function, and a mobile IP service registration part (206) that controls each functional block in the foreign agent and implements a signal processing of a mobile IP basic function.

Each constitutional element will be explained below in detail. The GGSN matching part (201) connects the GGSN (123) of the GPRS network and the mobile IP service registration (206) and matches the GGSN (123) through Gi+ as a separate interface at that time. Here, Gi+ is an interface in which Gi as an interface for connection through the Internet in the GPRS network is modified. In the present invention, it means an interface between the GGSN (123) and the foreign agent (131).

In particular, when a GPRS network subscriber requests a mobile IP service, the GGSN matching part (201) matches the network subscriber and carries out a separate interface processing function for supporting the mobile IP service. In addition, the matching part can make the subscriber take a mobile IP service registration procedure by using the information obtained through Gi+ as a separate interface.

Moreover, the authentication part (202) is connected with the mobile IP service registration part (206), generates a random number to be able to implant a challenge/response function, and carries out an authentication algorithm related to the foreign agent (131). Furthermore, for the authentication, the authentication part matches the DIAMETER protocol processing part (204).

In addition, the accounting processing part (203) is connected with the mobile service registration part (206), activated by a signal of the mobile IP service registration part (206), collects accounting information on packets passing through the foreign agent (131), and transmits the collected accounting information through the DIAMETER protocol processing part (204).

Moreover, the DIAMETER protocol processing part (204) encodes the information transmitted from the mobile IP service registration part (206) or accounting processing part (203) to a DIAMETER message and transmits the DIAMETER message to the authentication/accounting server (132), and the DIAMETER message received from the authentication/accounting server (132) is decoded and transmitted to the mobile IP service registration part (206) or accounting processing part (203).

Furthermore, the packet routing and tunneling control part (205) is called by the mobile IP service registration part (206), designates a routing table for the mobile node (11), and carries out the tunnel setup/cancellation function.

In addition, the mobile IP service registration part (206) controls each functional block in the foreign agent (131), is connected with the mobile node (11) and the home agent (133) to implement a signal processing of the mobile IP basic function, and is connected with the authentication/accounting server (132) through the DIAMETER protocol processing part (204).

Figure 3 is a structural diagram showing an application example of signal protocol stacks that are used in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

As shown in Figure 3, a signal protocol stack, which is used in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 of the present invention, consists of five layers. From the lowest layer, these layers are L1 layer, L2 layer, IP layer, UDP (User Datagram Protocol) and SCTP (Stream Control Transmission Protocol) or TCP (Transmission Control Protocol) layer, and Gi+, DIAMETER, and MIP+ layer.

The aforementioned five layers are compared with the layers at the same positions of the mobile node (11), GGSN (123), authentication/accounting server (132), and home agent (133) as follows.

The mobile node (11), GGSN (123), foreign agent (131), authentication/accounting server (132), and home agent (133) have L1 and L2 stacks as respective different lower layers. The double mobile node (11) has L1 and L2 as layers of GPRS radio access standards by the characteristic of the mobile node (11), and the GGSN (123) has L1 and L2 as layers for communications with SGSN as the previous step of the GPRS network and follows the ATM layer. In addition, L1 and L2 for matching the foreign agent (131) follow the Ethernet.

Moreover, as long as the foreign agent (131), authentication/accounting server (132), and home agent (133) can support the IP layer as the upper layer, L1 and L2 as the lower layers may follow any standard.

Furthermore, the third layer of each node is the IP layer. Here, IP means Ipv4 (Internet Protocol Version 4).

In addition, the mobile IP protocol stack is essentially required in the mobile node (11) to receive the support of the mobile IP service, and it is recommended that the mobile IP protocol stack use UDP in the lower layer. All UDP, which are used in the GGSN (123), foreign agent (131), and home agent (133), are the same protocol.

Here, UDP is a communication protocol for providing only limited services when messages are exchanged between computers in a network using IP, and UDP is an alternative of TCP. When it is used with IP, it is also expressed as UDP/IP. Similarly to TCP, UDP uses IP to receive an actual data unit called a datagram from one computer to other computers. However, unlike TCP, UDP does not provide a service that divides a message into packets (diagrams) and reassembles the packets at the other side, and especially, it does not provide the sequence of the arriving data packets.

Moreover, the mobile node (11) supports all existing standardized standards and standards whose standardization is in progress to support better mobile IP services (MIP+). This mobile IP+ protocol is constructed in the mobile node (11), foreign agent (131), and home agent (133) among the constitutional elements of the mobile IP network system. Here, the better mobile IP services (MIP+) will be explained in further detail. The better mobile IP services of the present invention support standards such as "Reverse Tunneling for Mobile IP (RFC2344)," "Mobile IPv4 Challenge/Response Extensions (RFC3012," "Mobile IP Network Access Identifier Extension for IPv4 (RFC2794)," IEFT draft: draft – letf – mobileip – aaa – key – 03.txt: "AAA Registration Keys for Mobile IP," draft – calhoun – aaa – diameter – 15.txt: "DIAMETER Base Protocol," and draft - calhoun – aaa – diameter – mobileip – 08.txt: "DIAMETER Mobile

IP Extension," etc., which are currently discussed, as well as the existing standardized mobile IP service standards.

Furthermore, GTP (GPRS Tunneling Protocol) is carried out for packet data services in a route from the radio data network controller (121) of the GPRS network to the GGSN (123), and as the lower protocols of GTP, the UDP layer and IP layer are used.

In addition, for matching of the GGSN (123) and the foreign agent (131), a Gi+ standard (307) prepared to support the better mobile IP services in the GPRS network is used. The Gi+ standard can support the better mobile IP services in the GPRS network while minimizing the standard of the GGSN (123) and the foreign agent (131).

Moreover, the protocol, which is used between the foreign agent (131) and the authentication/accounting server (132) and between the home agent (133) and the authentication/accounting server (132), is a DIAMETER protocol, and as its lower layer, SCTP (Stream Control Transmission Protocol) or TCP (Transmission Control Protocol) is used.

The DIAMETER protocol, which is a protocol that is used between the foreign agent (131) and the authentication/accounting server (132) and between the home agent (133) and the authentication/accounting server (132), also support a mobile IP as a protocol for authentication, authorization verification, and accounting in an Internet network.

Figure 4 is a structural diagram showing an application example of traffic stacks that are used in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

As shown in Figure 4, the traffic stacks, which are used in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention, consist of four layers of L1, L2, IP, and IP in IP layers.

Here, the lower L1, L2, and IP layers are the same as those of the signal protocol stacks of Figure 3. Therefore, the traffic stacks with the mobile node (11), GGSN (123), home agent (133), and other party node (41) around the IP in IP tunnel as the uppermost layer are as follows.

First, after the mobile node (11) completes the mobile IP service session setup and registration procedures in the asynchronous IMT-2000 system, if the mobile node (11) implements an application program such as Internet access, data packets from the mobile node (11) pass through the GTP tunnel set in the GGSN (123) of the GPRS network through UDT/TCP as a transmission layer and pass through the IP in IP tunnel for connecting the GGSN (123) and the foreign agent (131).

At that time, the IP in IP tunnel of the GGSN (123) and the foreign agent (131) is a two-way tunnel, and all the data packets, which are transmitted from the mobile node (11), are passed through the foreign agent (131) through the IP in IP tunnel with the GGSN (123) and the foreign agent (131), and all the packets, which are transmitted toward the mobile node (11), are

transmitted to the GGSN (123) through the IP in IP tunnel with the GGSN (123) and the foreign agent (131).

In addition, in the traffic route between the foreign agent (131) and the home agent (133), when the mobile node (11) is a home subscriber, the transmission with the other party node (41) is usually carried out by IP routing, and when the mobile node (11) accesses the GPRS network of a visiting subscriber, a tunnel with the foreign agent (131) is set in the home agent (133). In this case, as a basic tunneling protocol, the IP in IP tunnel is used.

The IP in IP tunnel, which is used in the present invention, means that a tunnel is set between a destination address and a source address of an external IP header by adding another IP header to a basic IP packet.

Figures 5a and 5b are flow charts showing the operations of an application example for mobile IP services in the foreign agent for supporting a mobile IP in the asynchronous IMT-2000 system of the present invention.

First, for mobile IP services, a registration for the mobile IP services must be made. Therefore, the registration process will be explained first.

For the mobile IP registration, the mobile node (11), which desires better mobile IP (MIP+), transmits a mobile IP service access request message to the GGSN (123) (501).

At that time, the mobile node (11) transmits a service pattern of a message, which is provided from the GPRS network, as a mobile IPv4 service and transmits it to the GPRS network (501). After receiving the service pattern, the GGSN (123) transmits a mobile IP service start request message to the foreign agent (131) (502).

After receiving the mobile IP service start request message, the GGSN matching part (201) of the foreign agent (131) transmits an agent advertisement message transmission request message to the mobile IP service registration part (206) (503), and the mobile IP service registration part (206) after receiving the message makes a challenge request for the authentication to the authentication part (202) and receives the result (504).

In response to the challenge request, the mobile IP service registration part (206) receives a challenge value from the authentication part (202) (504), prepares an agent advertisement message by using the received challenge value, and transmits the agent advertisement message to the matching GGSN matching part (201) (505).

In order to transmit the agent advertisement message to the mobile node (11), the GGSN matching part (201) inserts the aforementioned agent advertisement message into a mobile IP message transmission request message and transmits the request message to the GGSN (123) (506).

The GGSN (123) transmits the agent advertisement message included in the mobile IP message transmission request message to the mobile node (11) (507).

After receiving the agent advertisement message (507), the mobile node (11) transmits a mobile IP registration request message as a mobile IP+ protocol to the GGSN (123) of the GPRS network (508), and the GGSN (123) converts the registration request message into a mobile IP message transmission request message as a Gi+ matching message and transmits the transmission request message to the GGSN matching part (201) of the foreign agent (131) (509).

The GGSN matching part (201) of the foreign agent (131) interprets the mobile IP message transmission request message as a Gi+ matching message and transmits a mobile IP registration request message processing request message as a pure mobile IP+ message to the mobile IP service registration part (206) (510).

The mobile IP service registration part (206) reviews whether or not the challenge value included in the aforementioned mobile IP registration request message processing request message and the transmitted challenge value included in the agent advertisement message of the aforementioned (505) are the same, interprets a better mobile IP message so that a DIAMETER message can be prepared, generates a DIAMETER message transmission request message, and transmits the transmission request message to the DIAMETER protocol processing part (204) in the foreign agent (131) (511).

The DIAMETER protocol processing part (204) converts the received DIAMETER message transmission request message into an AA (Authentication, Authorization) – mobile node request message (MobileNodeRequest) as a DIAMETER message and transmits the mobile mode request message to the authentication/accounting server (132) (512).

The authentication/accounting server (132) processes the contents included in the received AA - mobile node request message, converts it into a home agent mobile IP request (HomeAgentMIPRequest) message, and transmits the request message to the home agent (133) (513), and the home agent (133) includes a mobile IP registration answer in a home agent mobile IP answer (HomeAgentMIPAnswer) message as its response message, and transmits the answer message to the authentication/accounting server (132) (514).

The authentication/accounting server (132) converts the received home agent mobile IP answer (HomeAgentMIPAnswer) message into an AA – mobile node answer (MobileNodeAnswer) message and transmits the mobile node answer message to the DIAMETER protocol processing part (204) of the foreign agent (131) (515).

The transmitted AA – mobile node answer (MobileNodeAnswer) message is analyzed in the DIAMETER protocol processing part (204), converted into a DIAMETER message processing request message, and transmitted to the mobile IP service registration part (206) (516).

Through the above processes, the registration of the mobile IP services for the mobile node (11) is made.

After the aforementioned registration process, the mobile IP service registration part (206) decides whether the mobile IP registration is successful or has failed. If the registration has failed, a mobile IP registration answer message is transmitted to the GGSN matching part (517), and if the mobile IP registration is successful, the authentication part (206) is requested to interpret session key information obtained from the received DIAMETER message processing request message (518).

In addition, if the authentication part (202) interprets the related session key, the mobile IP service registration part (206) confirms an authenticator included in the home agent mobile IP answer message, transmits an accounting start request message to the accounting processing part (203) (519), receives an accounting start request answer message for the accounting collection start from the accounting processing part (203) (520), requests that the packet routing/tunneling control part (205) make a packet routing or tunneling registration for the mobile node (11), and receives its answer (521).

After receiving the packet routing or tunneling registration from the mobile IP service registration part (206) at the aforementioned (521), the packet routing/tunneling control part (205) analyzes information included in the routing information registration request and sets a tunnel with the home agent (133) or sets up routing information to the GGSN (123) for the corresponding mobile node (11) (522).

On the other hand, the mobile IP service registration part (206) stores the related session information and subscriber information and makes a request for the next challenge to the authentication part (202) (523).

In addition, the mobile IP service registration part (206) transmits a mobile IP registration answer message including the related session information and subscriber information to the GGSN matching part (123) [sic; (201)] (524).

Next, the GGSN matching part (123) [sic; (201)] transmits a mobile IP registration answer message transmission request message, which requests the transmission of the mobile IP registration answer message (517, 524) to the mobile node (11), through Gi+ matching to the GGSN (123) (525), and the GGSN (123) transmits the mobile IP registration answer message (517, 524) to the mobile node (11) through the GPRS network by utilizing GTP ID information included in the Gi+ matching (526).

After receiving the mobile IP registration answer message (517, 524), the mobile node (11) decides whether or not the mobile IP service registration is successful and makes an attempt for access to the other party node (527).

Therefore, when an application program such as Internet access is implemented, IP in IP is passed through between the GGSN (123) and the foreign agent (131) through GTP from the

mobile node (11) to the GGSN (123), and in the foreign agent (131) IP routing is immediately carried out to access the other party node.

When a message is transmitted from the other party node to the mobile node (11), the message is transmitted up to the home agent (133) by general routing, and when the mobile node 11 is a home network, the home agent (133) transmits packets to the foreign agent (131) through a general IP routing function. When the mobile node is a visiting subscriber, packets can be transmitted to the foreign agent (131) through the IP in IP tunnel set between the home agent (133) and the foreign agent (131), the foreign agent (131) transmits the packets to the GGSN (123) through the IP in IP tunnel, and the GGSN (123) transmits these packets to the corresponding mobile node (11) through GTP.

As mentioned above, the method of the present invention can be realized with a program and stored in a pattern readable by a computer in a recording medium (CD-ROM, RAM, ROM, floppy disk, hard disk, photomagnetic disk, etc.).

It is evident to any person with ordinary knowledge in the technical field pertaining to the present invention that the present invention explained above is not limited to the aforementioned application examples and the attached figures but can be variously substituted, modified, and changed within the range where the technical concept of the present invention is not deviated.

Effect of the invention

As mentioned above, according to the present invention, a foreign agent, which readily receives new standards for a mobile IP, is constructed while minimizing the change in existing standards for mobile IP service support, thus enabling the support of better mobile IP services for supporting many standards, compared with the currently standardized protocols in the asynchronous IMT-2000.

In addition, according to the present invention, when the foreign agent is constructed, an interface with other radio access networks is easy, and the support of a DIAMETER protocol for the support and the authentication support of basic mobile IP services is separated, facilitating the extension of services.

Claims

1. A foreign agent device for supporting mobile IP services in an asynchronous mobile communication system, characterized in that in a foreign agent device that is used in an asynchronous mobile communication system, it includes a mobile IP service registration means that controls an internal means of said foreign agent device and processes signals for a mobile IP (Internal Protocol); a network matching means that is connected to said mobile IP service registration means and matched with the asynchronous mobile communication network; an

authentication protocol processing means that carries out transmission and reception through an authentication protocol with an authentication/accounting server of a mobile IP network by said foreign agent device; an authentication means that is connected with said mobile IP service registration means and said authentication protocol processing means and implements an authentication function at a foreign agent unit by the control of said mobile IP service registration means; an accounting processing means that is connected with said mobile IP service registration means and said authentication protocol processing means, collects accounting information on packets passing through said foreign agent by the control of said mobile IP service registration means, and transmits the collected accounting information; and a packet routing and tunneling control means that designates a routing table for a mobile node by said mobile IP service registration means and implements a setup/cancellation function of a tunnel.

2. The foreign agent device for supporting mobile IP services in an asynchronous mobile communication system as cited in Claim 1, characterized in that said authentication means generates a random number so that a challenge/response function can be carried out in accordance with the control of said mobile IP service registration means and implements an authentication algorithm related to said foreign agent device.

3. The foreign agent device for supporting mobile IP services in an asynchronous mobile communication system as cited in Claim 1 or 2, characterized in that said asynchronous communication network is a GPRS (General Packet Radio Service) network.

4. The foreign agent device for supporting mobile IP services in an asynchronous mobile communication system as cited in Claim 3, characterized in that said network matching means utilizes a Gi+ interface, in which a Gi interface that is used between the GPRS network and the Internet is modified, to match said GPRS network.

5. The foreign agent device for supporting mobile IP services in an asynchronous mobile communication system as cited in Claim 1 or 2, characterized in that said authentication protocol is a DIAMETER protocol.

6. A mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication network, characterized in that in a mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication system, it includes a first step for making a mobile IP service registration of a mobile node in a home agent by a mobile IP service start request signal of the mobile node received from an asynchronous mobile communication network through a network matching part by said foreign agent; a second step for transmitting a signal through the net matching part to inform the mobile node of a mobile IP registration failure through the asynchronous mobile communication network, if the mobile IP service registration at said first step fails; and a third step for accessing

said mobile node to the other party node through a routing and tunneling registration, if the mobile IP service registration at said first step is successful.

7. The mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication network as cited in Claim 6, characterized in that said first step includes a fourth step for receiving the mobile IP service start request signal of the mobile node from the asynchronous mobile communication network and making an agent advertisement message transmission request to a mobile IP service registration part by said net matching part; a fifth step for receiving a challenge value from the authentication part by said mobile IP service registration part after receiving the agent advertisement message transmission request at said fourth step, generating an agent advertisement message by using the challenge value, and transmitting the agent advertisement message through said network matching part; a sixth step for receiving the mobile IP registration message processing request through the asynchronous mobile communication network from the mobile node, which has received the agent advertisement message at said fifth step, and making an authentication message transmission request to the authentication protocol processing part by said mobile IP service registration part; a seventh step for transmitting an authentication request message to an authentication/accounting server and making the home agent generate a mobile IP registration answer by said authentication protocol processing part; an eighth step for receiving the mobile IP registration answer message generated at said seventh step through the authentication/accounting server by said authentication protocol processing part; and a ninth step for analyzing said mobile IP registration answer message received at said seventh step by said authentication protocol processing part, receiving the registration answer message, and making a mobile IP registration for the mobile node by said mobile IP registration processing part.

8. The mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication network as cited in Claim 7, characterized in that said third step includes a tenth step for confirming whether or not mobile IP registration for said mobile node is successful by said mobile IP registration processing part and requesting the authentication part to interpret session key information obtained from the mobile IP registration answer message received at said ninth step; an eleventh step for transmitting an accounting start request message to an accounting processing part to start accounting and receiving its answer by said mobile IP registration processing part; a twelfth step for making a packet routing or tunneling registration request for said mobile node to a packing routing/tunneling control part and setting up packing routing or tunneling registration information by said mobile IP registration processing part; and a thirteenth step for storing session information and subscriber information obtained through each process and setting the connection for said mobile node and

the other party node by transmitting a mobile IP registration answer message including said session information and said subscriber information.

9. The mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication network as cited in any of Claims 6-8, characterized in that said asynchronous mobile communication network is a GPRS (General Packet Radio Service) network.

10. The mobile IP service method using a foreign agent device that is used in an asynchronous mobile communication network as cited in any of Claims 6-8, characterized in that said authentication protocol is a DIAMETER protocol.

11. A recording medium readable by a computer, characterized in that a foreign agent device, which is used in an asynchronous mobile communication system having a processor, is provided with a recording medium that can be read by a computer in which programs for realizing a first function of making a mobile IP service registration of a mobile node for a home agent by a mobile IP service start request signal of the mobile node received from an asynchronous mobile communication network through a network matching part by said foreign agent, a second function of transmitting a signal through the network matching part to inform the mobile node of a mobile IP registration failure through the asynchronous mobile communication network, if the mobile IP service registration of said first function has failed, and a third function of accessing said mobile node to the other party node through a routing and tunneling registration, if the mobile IP service registration of said first function is successful, are recorded.

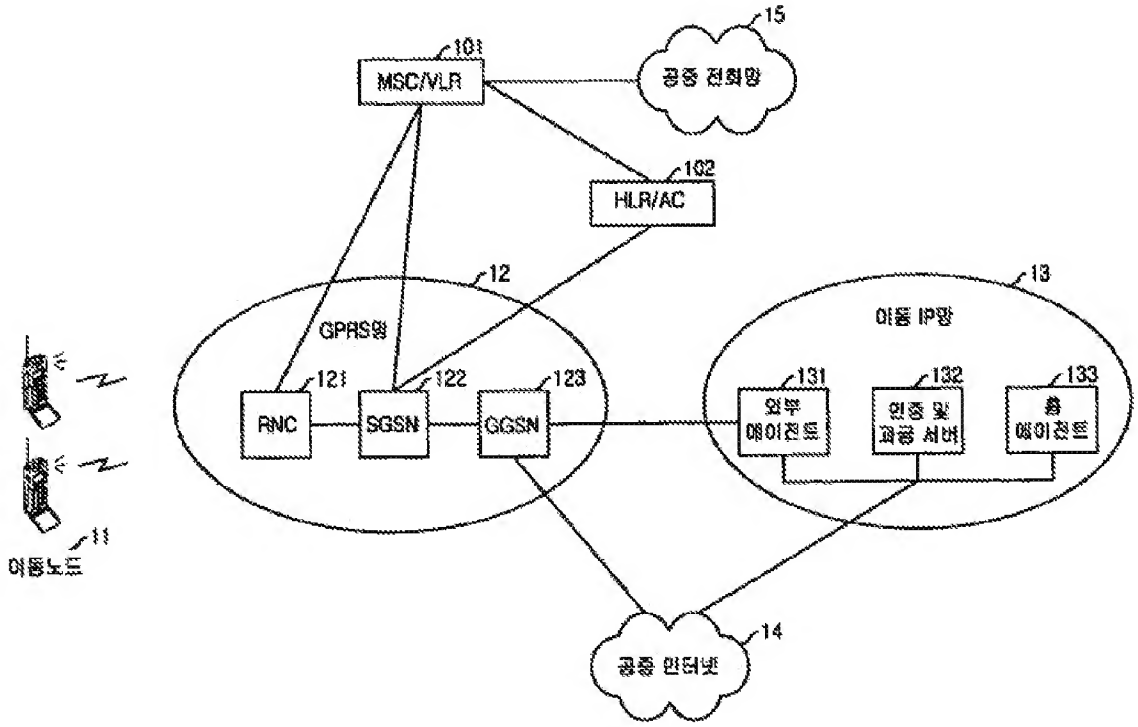

Figure 1

Key:
- 11 Mobile node
- 13 Mobile IP network
- 14 Public Internet
- 15 Public telephone network
- 131 Foreign agent
- 132 Authentication/accounting server
- 133 Home agent

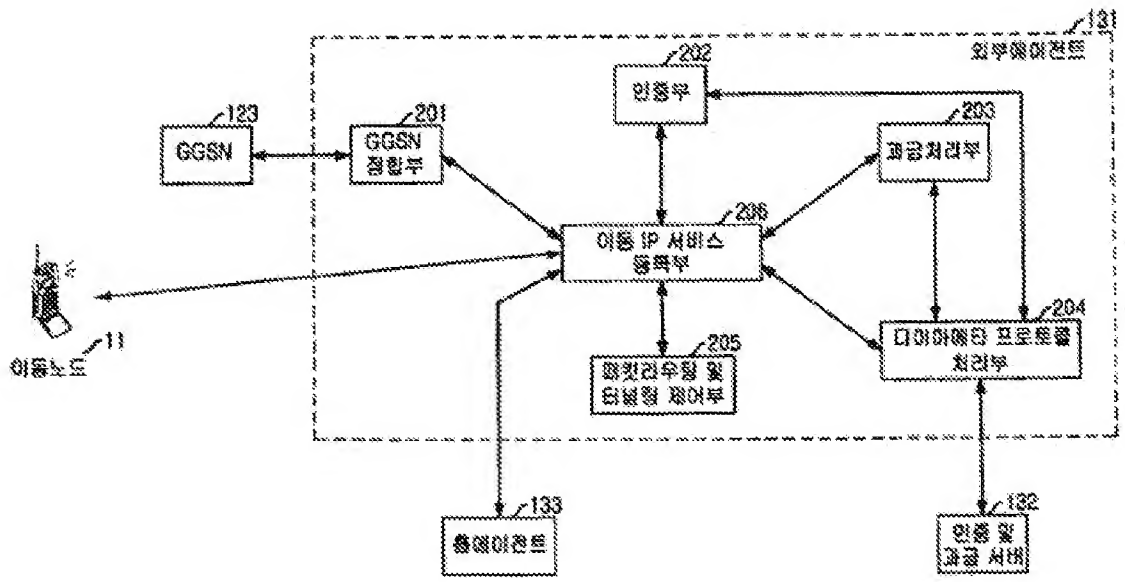

Figure 2

Key: 11 Mobile node
131 Foreign agent
132 Authentication/accounting server
133 Home agent
201 GGSN matching part
202 Authentication part
203 Accounting processing part
204 DIAMETER protocol processing part
205 Packet routing and tunneling control part
206 Mobile IP service registration part

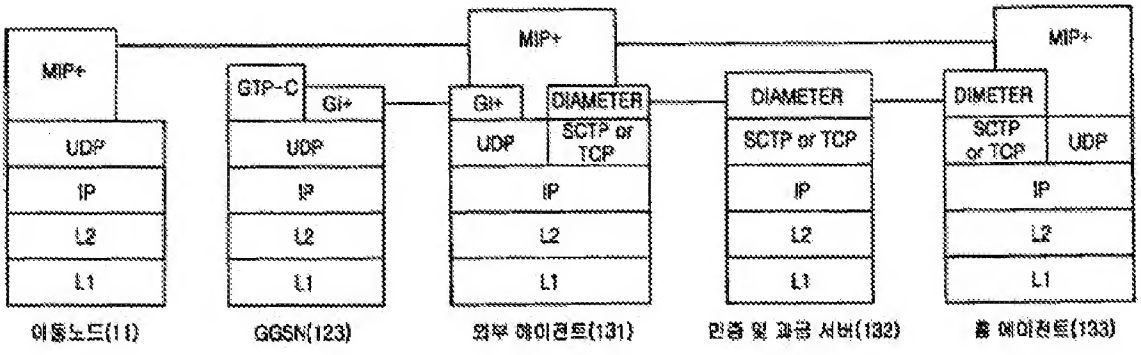

Figure 3

Key : 11 Mobile node
131 Foreign agent
132 Authentication/accounting server

133 Home agent

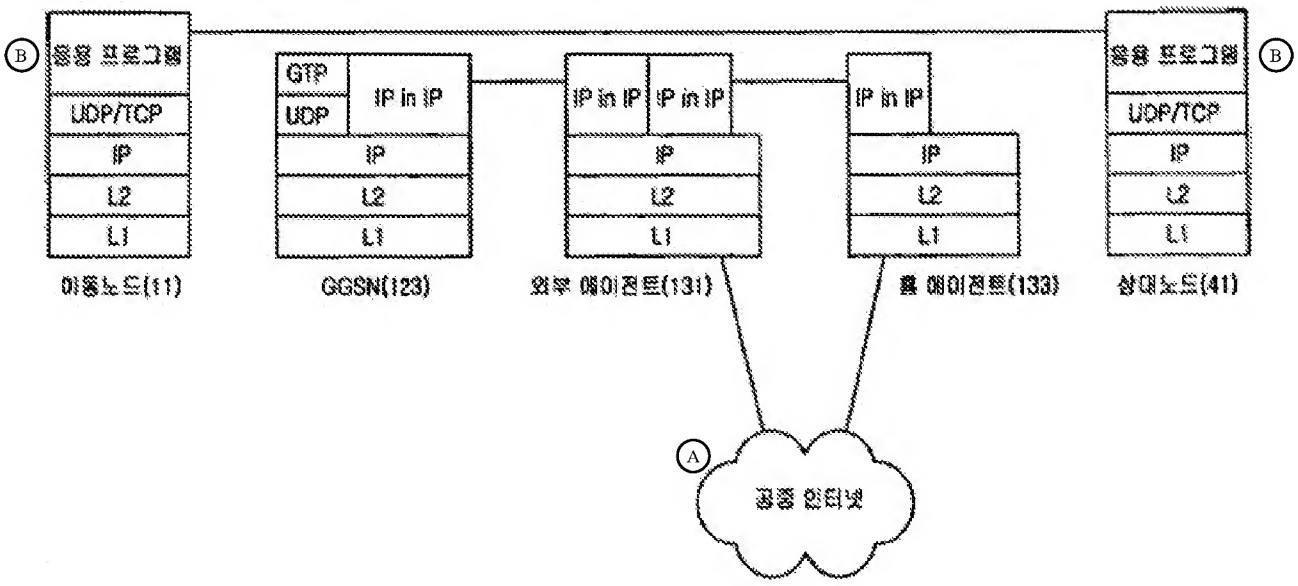

Figure 4

Key : A Public Internet
B Application program
11 Mobile node
41 The other party node
131 Foreign agent
133 Home agent

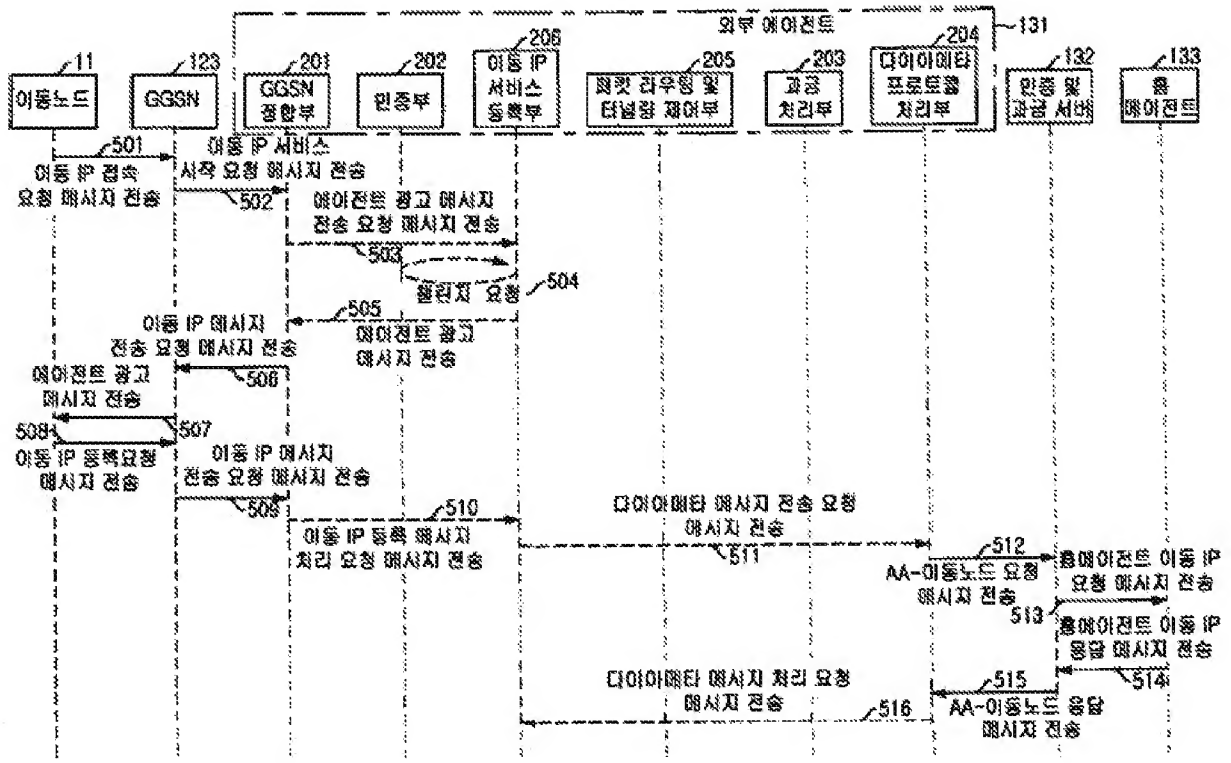

Figure 5a

Key:
- 11 Mobile node
- 131 Foreign agent
- 132 Authentication/accounting server
- 133 Home agent
- 201 GGSN matching part
- 202 Authentication part
- 203 Accounting processing part
- 204 DIAMETER protocol processing part
- 205 Packet routing and tunneling control part
- 206 Mobile IP service registration part
- 501 Mobile IP access request message transmission
- 502 Mobile IP service start request message transmission
- 503 Agent advertisement message transmission request message transmission
- 504 Challenge request
- 505 Agent advertisement message transmission
- 506 Mobile IP message transmission request message transmission
- 507 Agent advertisement message transmission
- 508 Mobile IP registration request message transmission
- 509 Mobile IP message transmission request message transmission
- 510 Mobile IP registration message processing request message transmission
- 511 DIAMETER message transmission request message transmission
- 512 AA – mobile node request message transmission
- 513 Home agent mobile IP request message transmission

514 Home agent mobile IP answer message transmission
515 AA – mobile node answer message transmission
516 DIAMETER message processing request message transmission

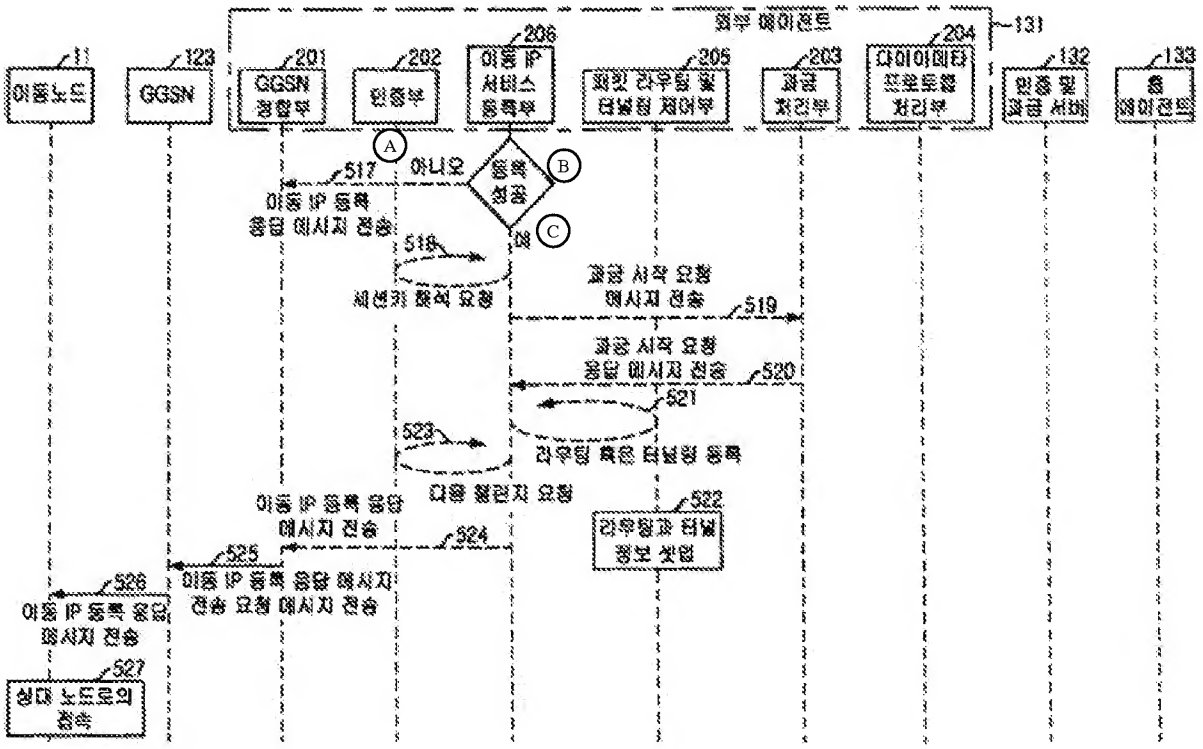

Figure 5b

Key: A No
B Registration success
C Yes
11 Mobile node
131 Foreign agent
132 Authentication/accounting server
133 Home agent
201 GGSN matching part
202 Authentication part
203 Accounting processing part
204 DIAMETER protocol processing part
205 Packet routing and tunneling control part
206 Mobile IP service registration part
517 Mobile IP registration answer message transmission
518 Session key interpretation request
519 Accounting start request message transmission
520 Accounting start request answer message transmission
521 Routing or tunneling registration

522 Routing and tunnel information setup
523 Next challenge request
524 Mobile IP registration answer message transmission
525 Mobile IP registration answer message transmission request message transmission
526 Mobile IP message registration answer message transmission
527 Access to the other party node